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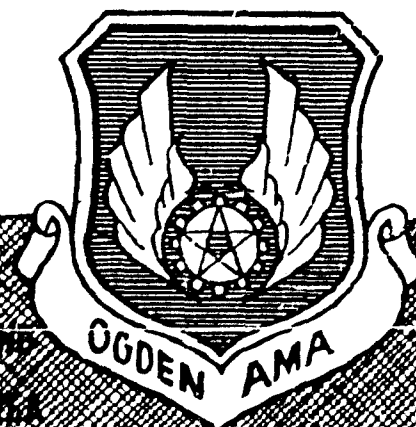
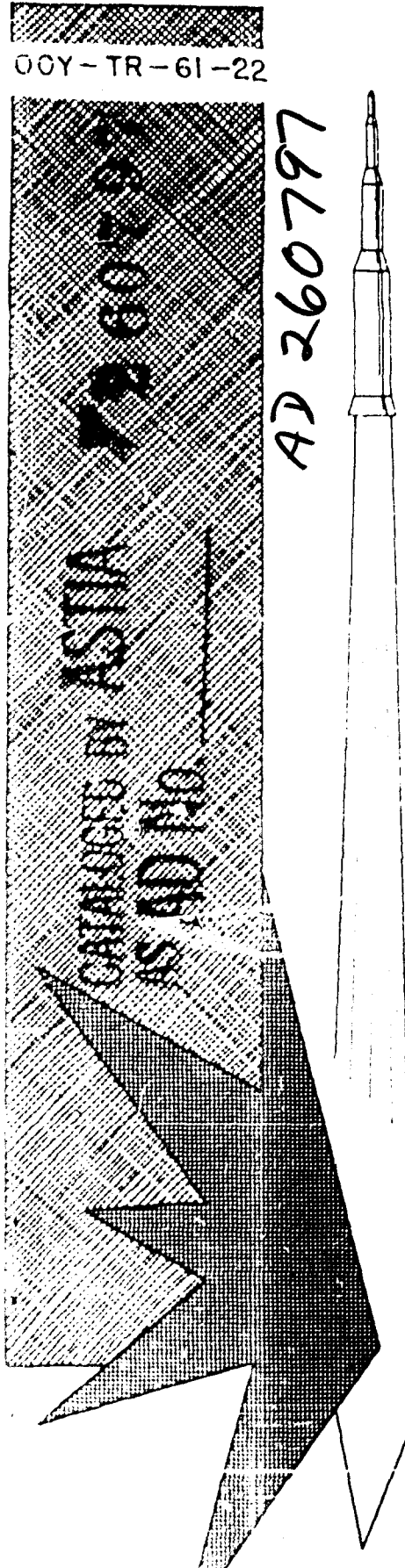
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OOAMA

AIRMUNITIONS TEST REPORT

EXPLOSIVES SAFETY

ELECTROMAGNETIC RADIATION
HAZARDS TO EXPLOSIVES SURVEY
OF ELLSWORTH AIR FORCE BASE,
SOUTH DAKOTA



OGDEN AIR MATERIEL AREA

UNITED STATES AIR FORCE • ELLSWORTH AIR FORCE BASE, S.D.

ELECTROMAGNETIC RADIATION HAZARDS TO EXPLOSIVES

SURVEY OF ELLSWORTH AIR FORCE BASE, SOUTH DAKOTA

by

Harold R. Laughter

PUBLICATION REVIEW

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JUNE 1961

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OGDEN AIR MATERIEL AREA
AIR FORCE LOGISTICS COMMAND
UNITED STATES AIR FORCE
Hill Air Force Base, Utah

NOTICES

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The conclusions and recommendations made in this report are not to be considered directive in nature. This type information becomes official only when published in Technical Orders and/or other applicable Air Force publications.

ADMINISTRATIVE DATA

PURPOSE OF TEST:

The purpose of this survey was to determine the extent of electromagnetic radiation hazards to explosives storage, handling and shipping areas in the vicinity of the A.C. and W. site at Ellsworth Air Force Base, South Dakota.

ITEMS TESTED:

Ten S-68 Squibs, FSC 1375-035-6021-MB46
Ten E-81 Squibs, FSC 1375-041-1312-M138
Five Rounds of 20 MM, M55 (TP) Ammunition, FSC 1305-529-7208-A891 (Electric Primers)
Two 2.75 Inch FFAR Rockets, FSC 1340-038-8192-H500
Two MK 165 Igniters, FSC 1340-309-5095-H403
Two MK 15 Igniters
Two GAR 1 and 2A Motor and Nozzles

SECURITY CLASSIFICATION:

Unclassified

DATE TEST COMPLETED:

January 1961

SURVEY CONDUCTED BY:

OOAMA (OOYSS) - 2705th Airmunitions Wing

Project Engineer: Harold R. Laughter

ABSTRACT

The purpose of this survey was to determine the extent of electromagnetic radiation hazards to explosives in storage, handling and shipping areas in the vicinity of the A.C. and W. site at Ellsworth Air Force Base, South Dakota. Field strength measurements of the main beams from the AN/FPS-20 and AN/MPS-14 radars were made at various locations in the aforementioned areas and along the transportation route. Various electrically initiated explosive items were exposed to the main beam of the radars, following the highest terrain possible into the AN/MPS-14 radar system. It was concluded that a degree of hazard does exist along the transportation route to the munitions storage area.

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INTRODUCTION

This survey was initiated to obtain data and information necessary to determine the extent of the electromagnetic radiation hazards to explosive storage, handling and shipping areas in the vicinity of the A.C. and W site at Ellsworth Air Force Base, South Dakota.

This survey was conducted under the provision of a General Test Plan for Electromagnetic Radiation Hazards at Ellsworth Air Force Base. The test plan was prepared by the Explosive Evaluation Branch (OOYEE) and coordinated with the Safety Requirements Branch (OOYSS). This survey was conducted by the Safety Requirements Branch (OOYSS), 2705th Airmunitions Wing with support from the 43d Munition Maintenance Squadron at Ellsworth Air Force Base, 740th A.C. and W. Squadron at Ellsworth Air Force Base, and Central GEEIA Region at Tinker Air Force Base.

Electrically initiated explosive items and initiators were selected on the basis of their relative sensitivity to electromagnetic energy.

DESCRIPTION

The following is a description of the electrical characteristics of the items tested:

1. S-68 Squib, FSC 1375-035-6021-M846 resistance 1.37 ± 0.50 ohms, Maximum no-fire current 0.30 ampere.
2. S-75 Squib, FSC 1375-529-9301-M856 resistance 5.0 ± 1.0 ohms, 100% fire current 0.58 ampere.
3. E-81 Blasting Cap, FSC 1375-041-1312-M138 resistance 1.57 ± 0.50 ohms, Minimum fire current 0.50 ± 0.05 ampere.
4. 20 MM, M55 (TP) Ammunition, FSC 1305, contains primer M52A3, resistance 1000 to 5,000,000 ohms, fire voltage 115.
5. 2.75 FFAR Rocket, FSC 1340-038-8192-H500, igniter use a MK 1 Mod 0 Squib 0.30 all fire, 0.20 no fire, resistance 1.0 ± 0.3 ohms.
6. Igniter, Mk 165 for 15KS1000 JATO, FSC 1340-309-5095-H403 contains an electrically activated glow plug - resistance 0.25 ohms, operating current 25 amperes.

7. Igniter, M15 for 16NS1000 JATO, contains two M-2 Squibs, resistance 0.75-1.25 ohms, minimum fire current 0.545 ampere.

8. Motor and Nozzle, GAR 1 and 2, with igniter M50 and fuze T1403E3. M50 igniter contains M107A squib resistance 0.70 ohms, 0.25 ampere maximum no fire current. T1403E3 fuze contains two M4 dimple motors 5-9 ohms resistance 1.00 ampere. Current 100% fire, 0.1 ampere maximum no fire current. Also contains two M52 detonators, 55 volts, 100% fire resistance 1000-10,000 ohms.

The DuPont S-68 and S-75 squibs and E-81 blasting caps are similar in construction. They consist of a copper shell closed at one end and sealed at the other end by crimpings around a 3/8 inch long rubber plug. Two copper wires are molded into the rubber plug. Across the inside ends of the wires is connected a resistance wire called a bridge wire and around the bridge wire is a sensitive explosive mixture known as the ignition bead which ignites the charge.

In the blasting caps the ignition bead ignites a filler charge which ignites a primer charge, this sets off the base charge. The squib or blasting cap is initiated by passing a small current through the lead wires which in turn passes through the bridge wire. The bridge wire is heated by the current which causes ignition at a predetermined temperature (Figures 1 and 2).

20 MM Ammunition consists of a cartridge case, which is usually brass, a projectile or bullet, a quantity of propellant powder and an electric primer. The electric primer consists of a brass cup with a hole in the cupped end, into which is assembled a brass button separated from the cup by a vinylite insulator, followed by a consolidated charge of a conductive primer mixture, a shellacked foil paper disk; finally, a thin gilding-metal cup support is pressed into the body. The insulator is red in color. The charge weighs 2.75 grams (max.). The electrical path is from the face of the button exposed through the hole in the cup, through the button, and then through the conductive mixture to the cup. The primer is initiated by electrical energy. (See Figure 3.)

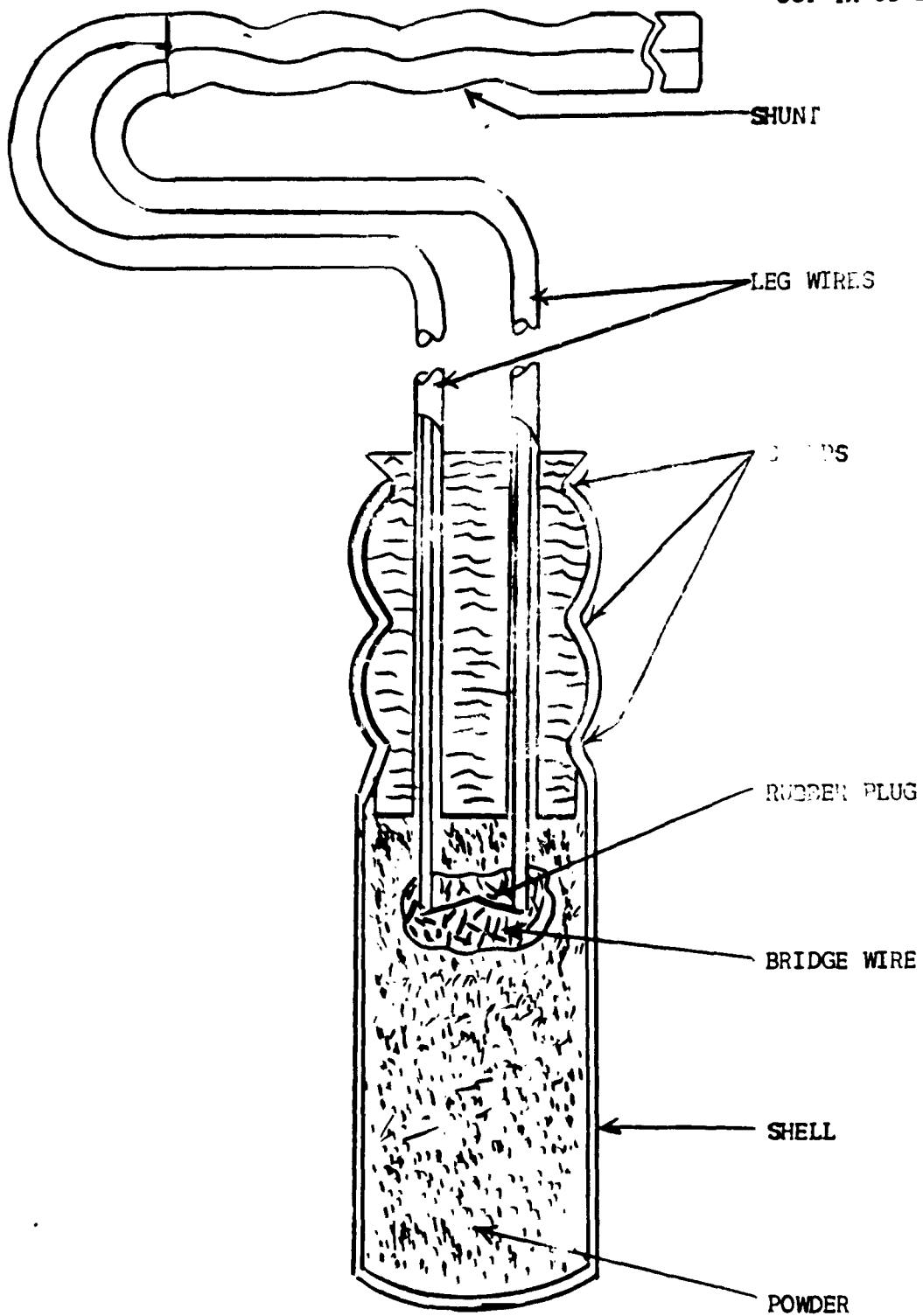


FIGURE 1. Cross-Section Drawing of Squib.

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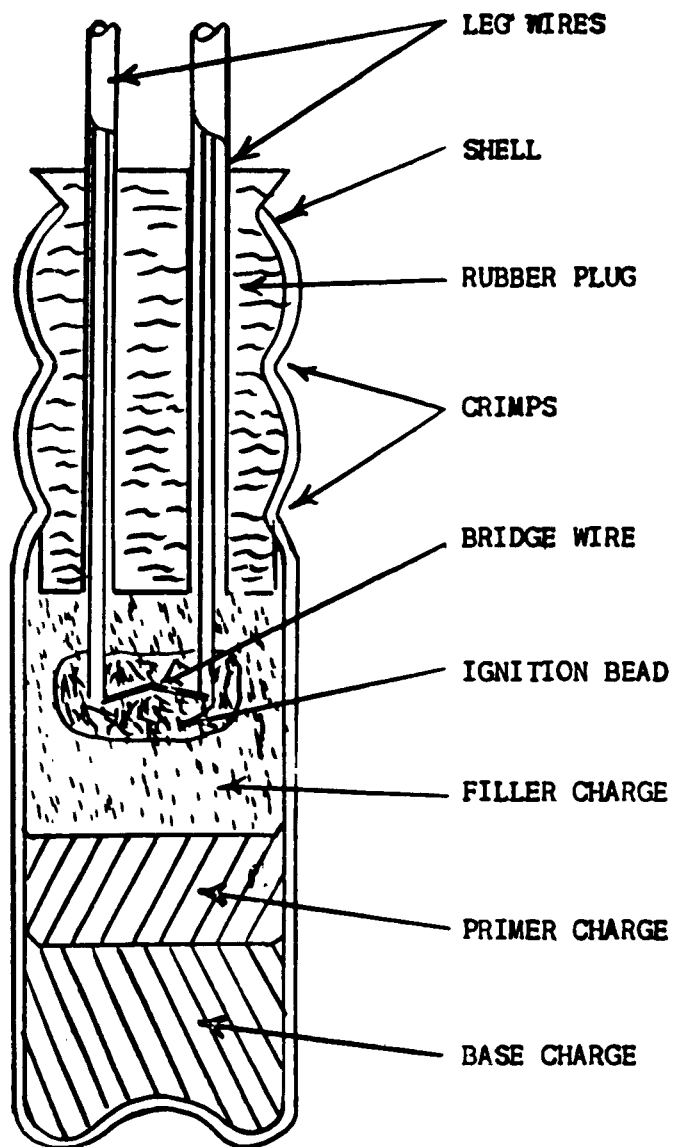


FIGURE 2. Cross-Section Drawing of Blasting Cap.

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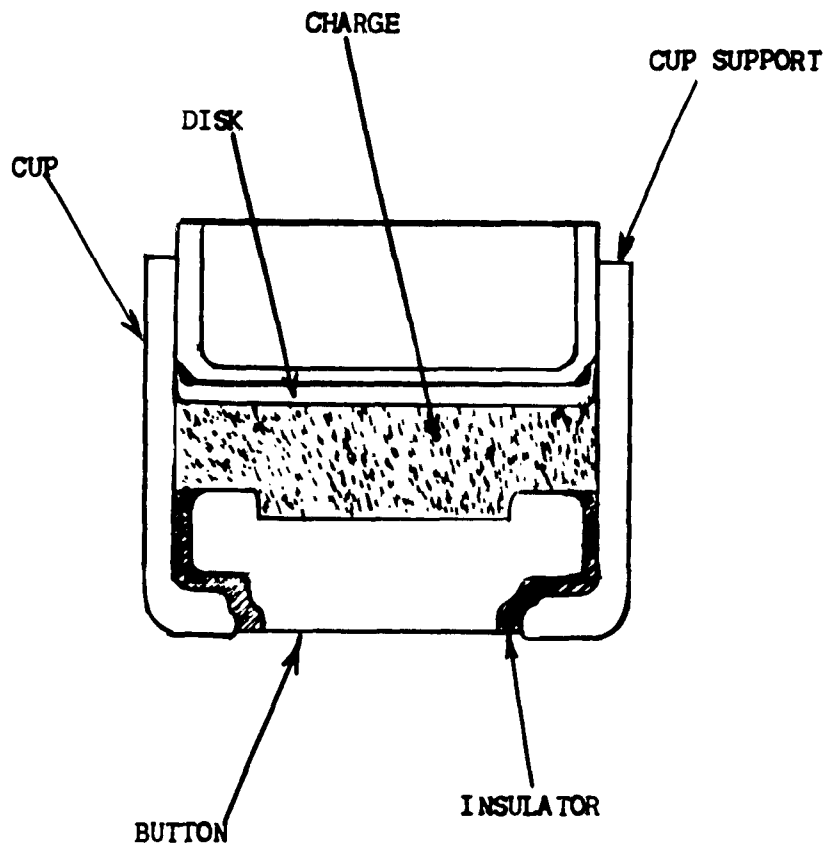


FIGURE 3. Electric Primer MS2A381 - Enlarged.

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The 2.75 Inch fin-stabilized aircraft rocket consists of a nose fuze, head, and motor. The motor consists essentially of an aluminum alloy tube containing propellant and an igniter, and has a nozzle-fin assembly attached to the aft end. The igniter is a metal case containing a mixture of black powder and magnesium powder, and an electric squib, and is located in the forward end of the motor. Two lead wires from the squib extend from the igniter passing through the perforation in the propellant grain to the nozzle plate where one lead wire is grounded to the nozzle plate. The other lead wire passes through the nozzle and is connected to the contact disk at the aft end of the rocket as the live contact.

The Mk 165 igniter consists of an electrical actuated glow plug that ignites black powder which in turn ignites the main charge contained in a steel mesh case.

The M15A1 igniter consists of 55 grams of sustainer cast in the base of the igniter plug, and about 100 grams of pellets. Two M-2 squibs with aluminum sleeves are embedded in the sustainer propellant in the base of the igniter plug, with the firing end directed into the pellets. The pellets are contained in a one-quarter-inch wire mesh basket which has been dipped in a Tenite and rubber solution. Cotton packing is placed in the top of the wire basket to reduce pellet attrition during rough handling. The wire mesh basket is held onto the igniter plug by a strip key, and the bottom of the basket is sealed to the igniter plug with rubber cement. (See Figure 4.)

The GAR 1 and 2 motor case is made of steel and painted aluminum. The open end of the motor case is tapered and threaded to receive the adapter, which is threaded to receive the nozzle. These motors are approximately 36.74 inches long including nozzle, 5.848 inches diameter forward and 6.186 inches diameter at thrust flange. The M50 igniter used with the GAR 1 and 2 motor is 16.00 inches long and 0.62 inches in diameter. It contains two M107A squibs. The fuze for the GAR 1 and 2 contains two dimple motors M4, and two detonators, M52. The electrical connections to metal inclosure of the fuze consist of quarter-inch pins.

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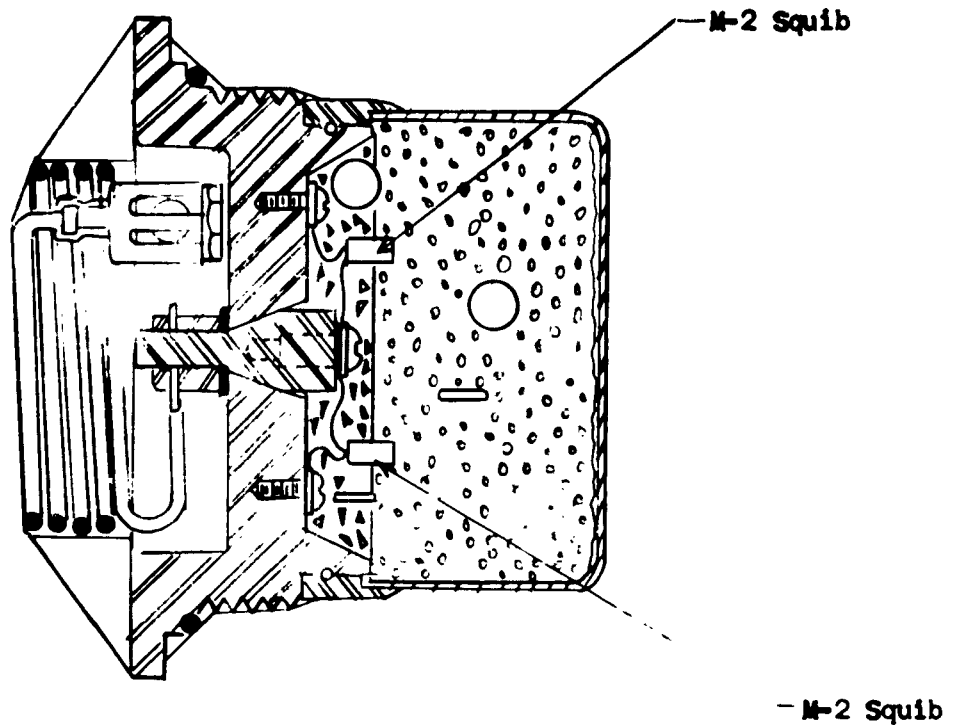


FIGURE 4. Igniter 16-NS-1000.

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EQUIPMENT

The following equipment (Figure 5) was used during the survey:

1. Polorad field strength meter model FIM mounted in van (Figures 6 and 7).
2. Radar transmitter AN/MPS-14 (the AN/MPS-14 transmitter is identical to the AN/FPS-6 transmitter).
3. Radar transmitter AN/FPS-20.
4. Flat-bed 1-1/2 ton truck.
5. Press type camera.

TEST PROCEDURES AND RESULTS

Field strength measurements were made in the munitions storage area at various locations among the igloos and warehouses. Attempts were made to take the readings in locations where the field strengths would be at a maximum and yet be in a position where explosive materials would be frequently handled. Readings were taken of transmitted signals from both the AN/FPS-20 and AN/MPS-14 radars. There was evidence of signal reinforcement. Reflections from the iron doors on the igloos and warehouses plus multipathing accounted for the reinforcement. In no event was the signal strength more than doubled by reflections and multipathing.

Additional field strength measurements were made along the transportation route to and from the storage area. The terrain features were such that the road dropped at approaches to the radars reducing the hazard. The original survey conducted, 23-27 January 1961, indicated relatively little hazard as the AN/MPS-14 radar antenna did not read below a minus 30 minutes. Subsequently the radar antenna was overhauled and an electrical alignment check showed the antenna nods to a minus 2 degrees as specified in the AN/MPS-14 specifications. Also, a field strength measurement was made at the Rushmore Air Force Station gate for information purposes.

The test samples, as listed in the administrative data and described previously, were arranged in various positions on a flat bed 1-1/2 ton truck. Arrangement of the samples was such as to present the more sensitive areas to the radars. Example, the GAR 1/2 motor was situated with the nozzle facing the radars; the nozzle functioning as a horn antenna. Squibs and blasting caps were taped on a sheet

of plywood with the lead wires forming various antenna configurations. Some of the antenna configurations are as follows: loop, rhombic, long wire and dipole. (See Figures 7, 8, and 9.)

The truck with the test samples was backed into the concentrated radar beam following the highest possible terrain. (See Figures 10 and 11 for profile.) Exposures of the samples were made at 10 minute intervals in 200 foot increments from 4071.5 feet to 1271.5 feet, then in 100 foot increments to 271.5 feet from the center of the AN/MPS-14 radar tower. Field strength measurements were made at each interval.

A comparison of measured readings with the theoretical is shown in Figure 12 and Table 1. The measured values increased considerably over the theoretical as the instrument approached the radar. This is due to R.F. leakage, as the instrument was not shielded. Figure 12 also shows that the measured values do not fall into a smooth curve. These measurements are not made under free space conditions. The variations are accounted for and due to multipath and reflections. Subsequent measurements made, when checking the electrical alignment of the AN/MPS-14 radar antenna, was nearly double the theoretical values. This again is explained by multipathing and reflections.

None of the samples were initiated. This is attributed to two factors:

1. The AN/MPS-14 radar antenna was nodding to only a minus 30 minutes. The antenna has since been overhauled and nods to a minus 2 degrees.
2. The adverse weather conditions. During the survey temperatures were near zero and the wind velocity between 10 and 30 miles per hour.

CONCLUSIONS

Present operating procedures of the 43d Munitions Maintenance Squadron are safe. However, caution must be exercised when transporting electro-explosive devices to and from the munition storage area. All vehicles transporting electro-explosive devices or weapon systems containing electro-explosive devices must transport them in their original packaging and remain on Ramp Street to South Drive, then take South Drive directly to the Storage area. Terrain conditions reduce the hazard to some extent (Figure 13). However, there are areas which are potentially hazardous. These areas are marked on Figure 14.

RECOMMENDATIONS

1. It is recommended that all future surveys be conducted when the average ambient temperature is 70°F or above if it is possible.
2. It is recommended, that where Polarad field strength meter, Model FIM, is used, it be shielded.

CALCULATIONS

Original reading in db above 1 microvolt.

AN/MPS-14 radar transmitting on a frequency of 2.800 MC.

AN/FPS-20 radar transmitting on a frequency of 1300 MC.

Loss in cable @ 2800 MC = 3.5 db.

Loss in Cable @ 1300 MC = 2.7 db.

Free space conversion from polarad graphs @ 2800 MC = 22.1

Free space conversion from polarad graphs @ 1300 MC = 22.8

A. Received peak power measured from AN/MPS-14 radar in front of building number 9016 = 148 dbμ

$$\text{Total db u/m} = 148 + 3.5 + 22.1 = 173.6 \text{ dbμ/m}$$

$$\text{db} = 20 \text{ LOG } E$$

$$173.6 = 20 \text{ LOG } E$$

$$\text{LOG } E = 8.68$$

$$E = 478.6 \text{ Volts/Meter}$$

$$\text{Power Density} = \frac{E^2}{Z^0}$$

$$Z^0 = \text{Impedance of Free Space} = 120\pi = 377$$

$$\text{Power Density} = \frac{E^2}{Z^0} = \frac{(478.6)^2}{377}$$

$$= 0.0608 \text{ Watt/Cm}^2 \text{ peak power}$$

AN/MPS-14 Peak Power Output = 5,000,000 Watts

Average Power Output = 3600 Watts

$$\text{Average Power Density} = 0.0608 \times \frac{3600}{5,000,000}$$

$$= \underline{\underline{0.0438}} \times 10^{-3} \text{ Watts/Cm}^2$$

B. Theoretical Power Density.

Far Field Formula

$$W = \frac{P_T A_6}{4\pi d^2}$$

W = Power Density
 P_T = Transmitted Power
 A_6 = Power Gain of Antenna
d = Distance in Centimeters from Antenna

AN/MPS-14 RADAR

Power Output Average = 3600 Watts
Antenna Gain = 7400
Distance from AN/MPS-14 Radar Tower to Front of Bldg 9016 =
3775 feet
3775 feet = 30.48 X 3775 = 115062 CM

$$\begin{aligned} \text{Power Density} &= \frac{3600 \times 7400}{4\pi (115062)^2} \\ &= 0.178 \times 10^{-3} \end{aligned}$$

Near Field Corrections

$$F_f = F_1 \times F_2$$

1st Step

$$a = \frac{L_1}{\sqrt{2d\lambda}}$$

$$b = \frac{L_2}{\sqrt{2d\lambda}}$$

L_1 = Vertical dimension of antenna aperture in meters.
 L_2 = Horizontal dimension of antenna aperture in meters.
d = Distance from antenna in meters.
 λ = wave length in meters.

AN/MPS-14 RADAR

$$L_1 = 9.13 \text{ meters}$$

$$L_2 = 2.28 \text{ meters}$$

$$a = \frac{L_1}{\sqrt{2d\lambda}} = \frac{9.13}{\sqrt{2 \times 1150.62 \times 0.107}} = \frac{9.13}{15.7}$$

$$a = 0.582$$

$$b = \frac{L_2}{\sqrt{2d\lambda}} = \frac{2.28}{\sqrt{2 \times 1150.62 \times 0.107}} = \frac{2.28}{15.7}$$

$$b = 0.145$$

2d STEP

From Figure C-2 in Technical Order 31-1-80

The value of F_1 , corresponding to a value 0.582 for "a" is 1

The value of F_2 , corresponding to a value of 0.145 for "b" is 1

$$F_f = F_1 \times F_2$$

$$F_f = 1 \times 1 = 1$$

$$\text{Power Density} = 0.178 \times 10^{-3} \times 1 = \underline{\underline{0.178 \times 10^{-3} \text{ Watts/CM}^2}}$$

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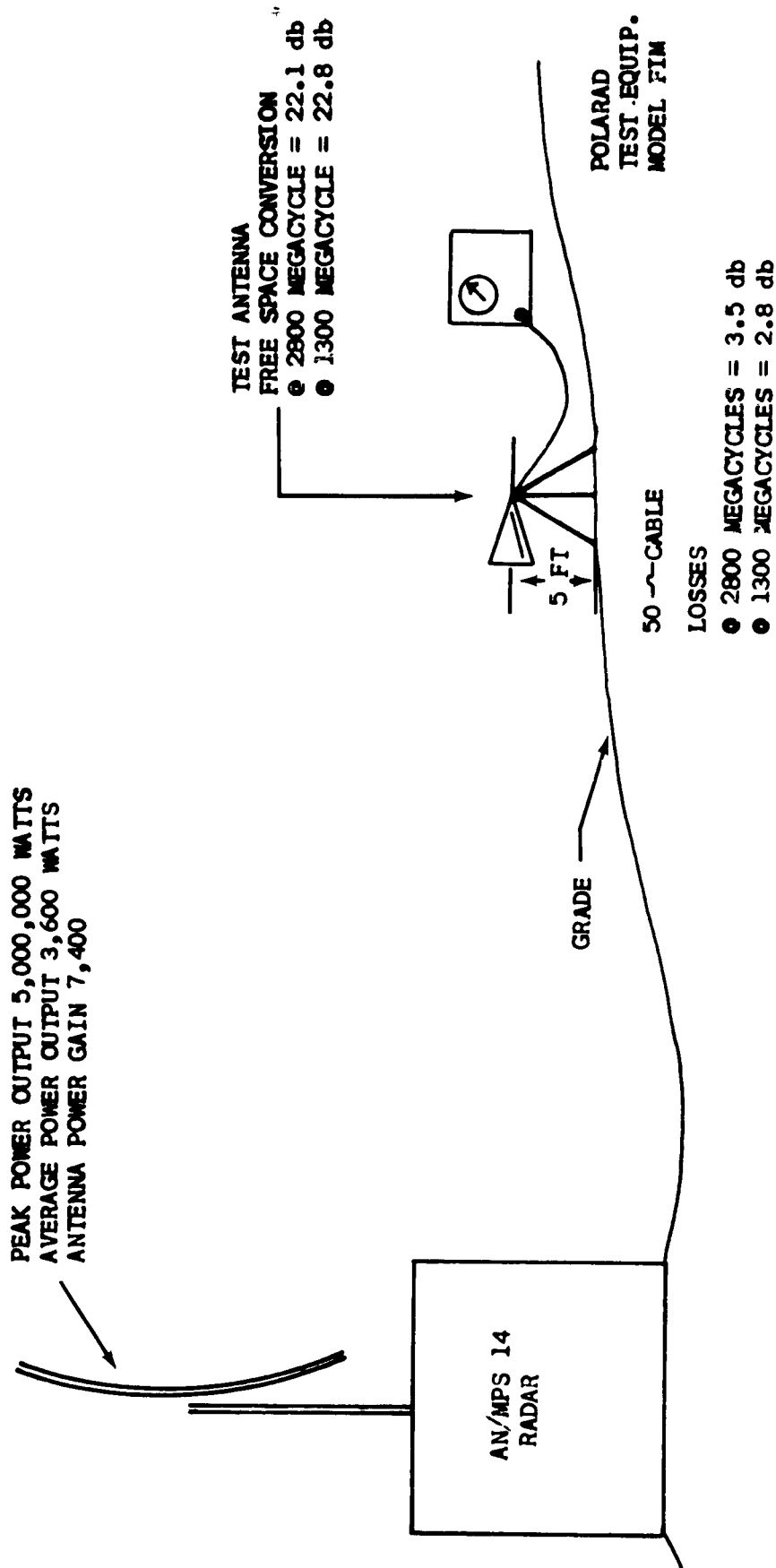


FIGURE 5. Test Instrumentation.

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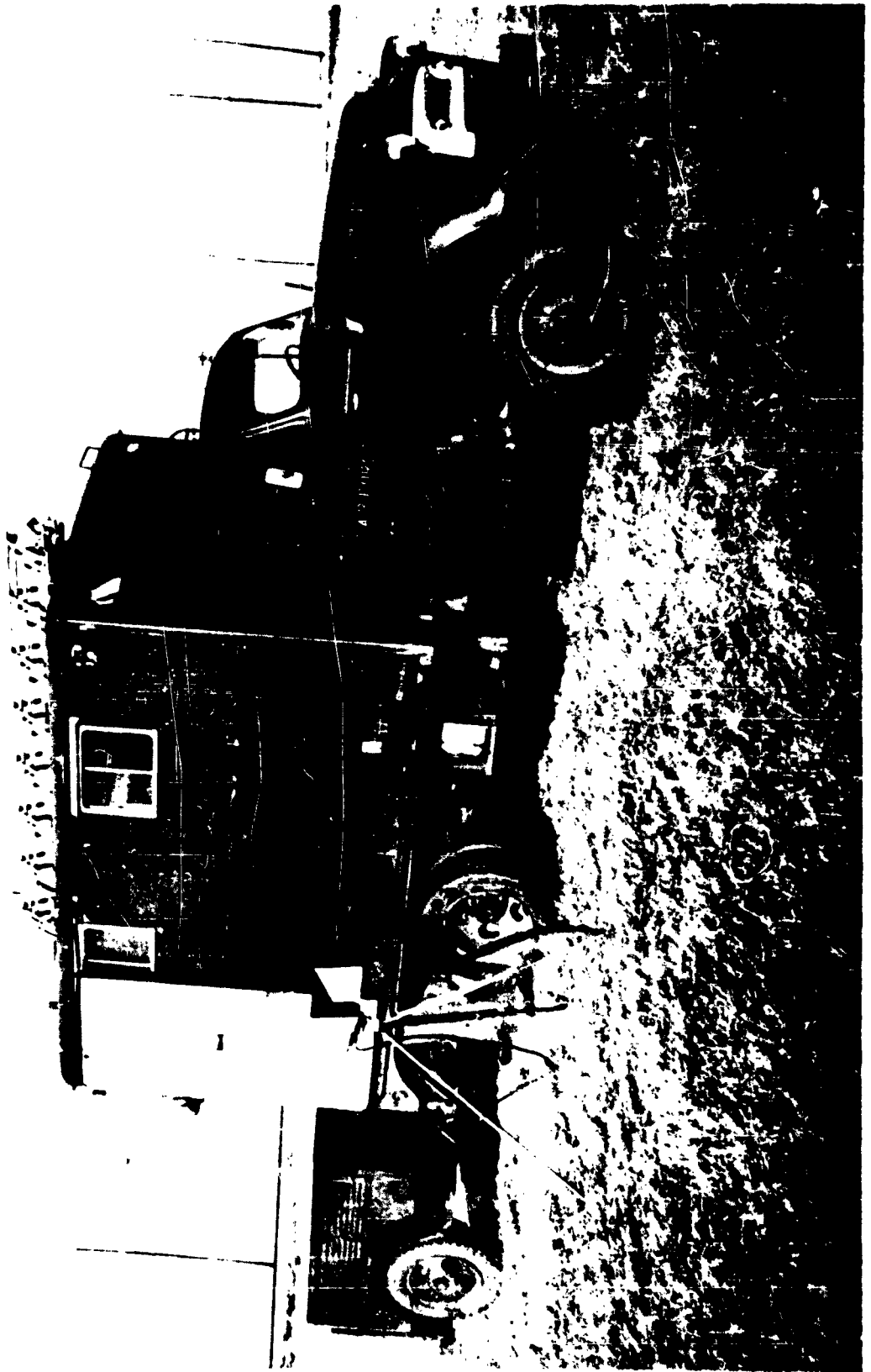


FIGURE 6. Van With Test Instruments and Power Supply.

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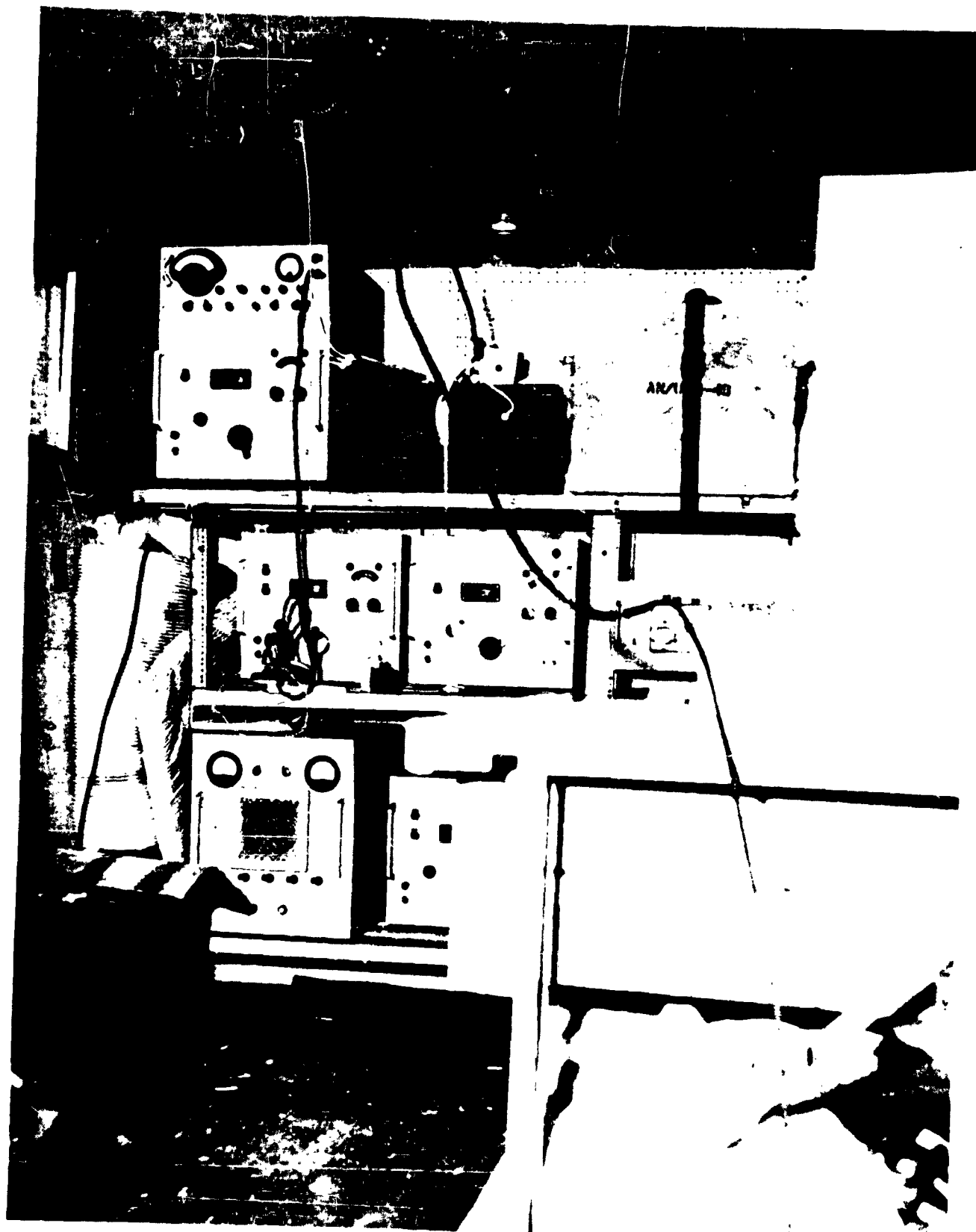


FIGURE 7. Inside Test Van.

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FIGURE 8. Layout of Electrical Initiated Explosive Devices as Exposed to R.F. Energy.

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FIGURE 9. Top View of Electrical Initiated Devices as Exposed to R.F. Energy.

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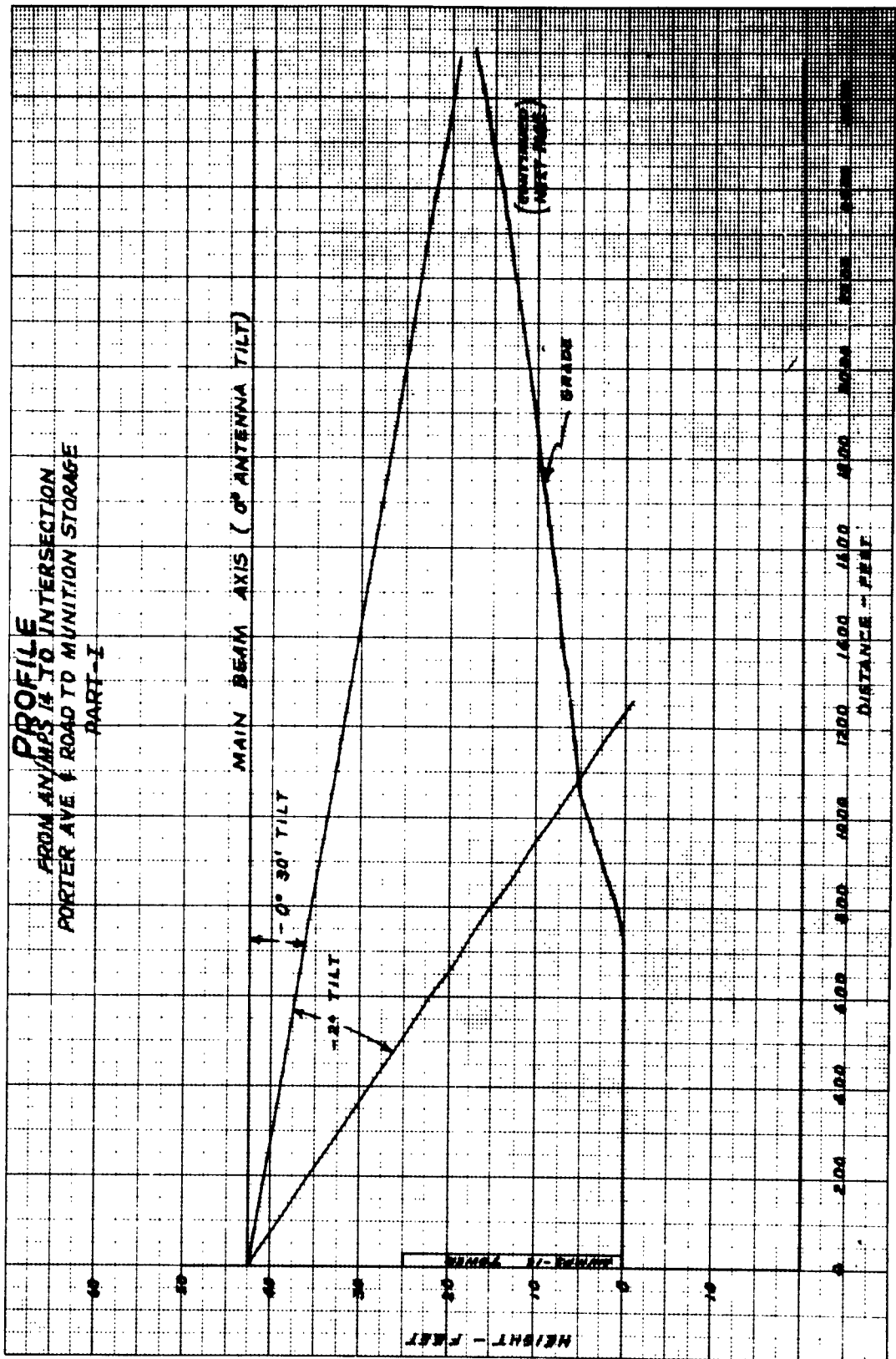


FIGURE 10.

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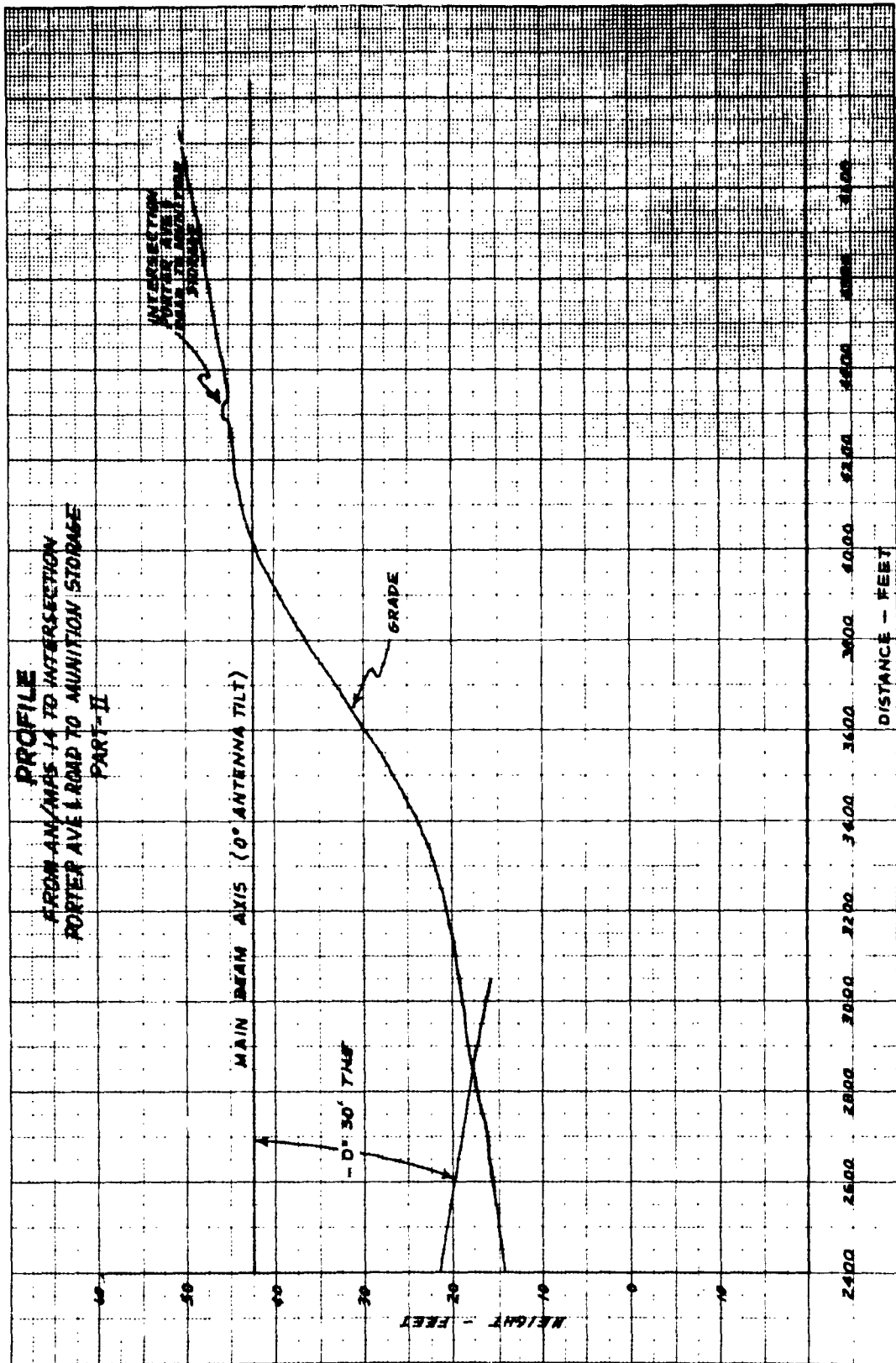


FIGURE II.

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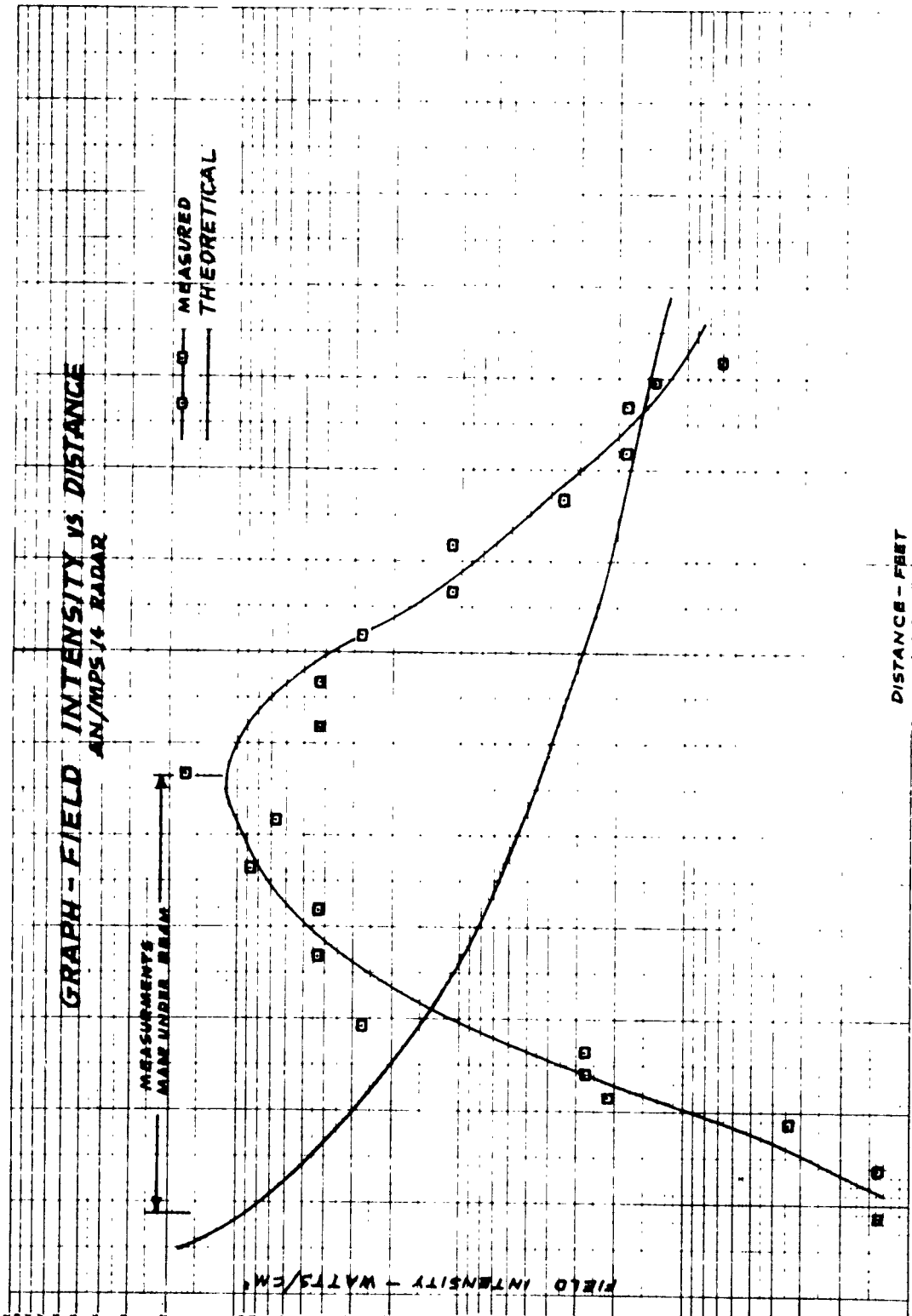


FIGURE 12.

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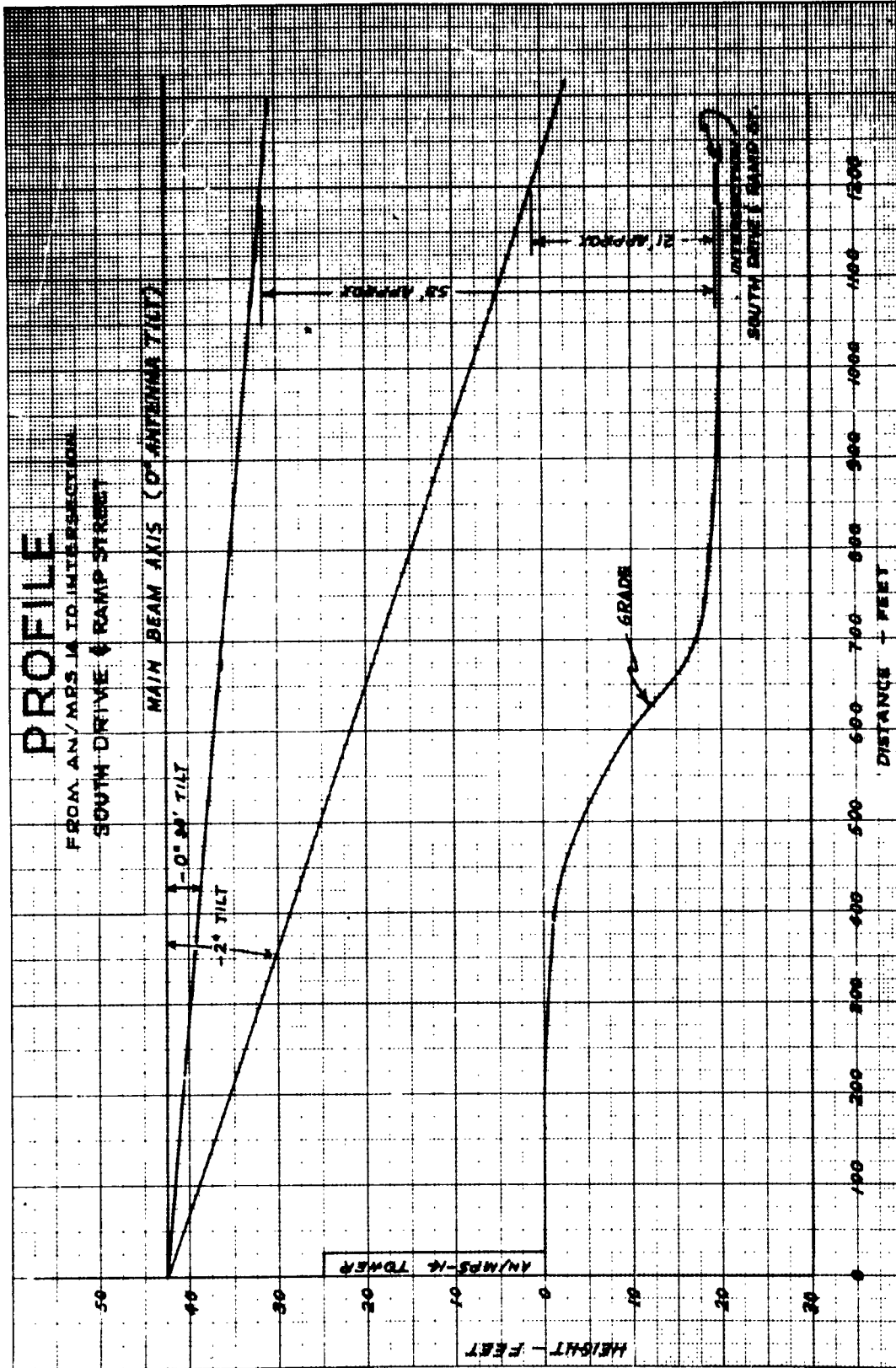


FIGURE 13.

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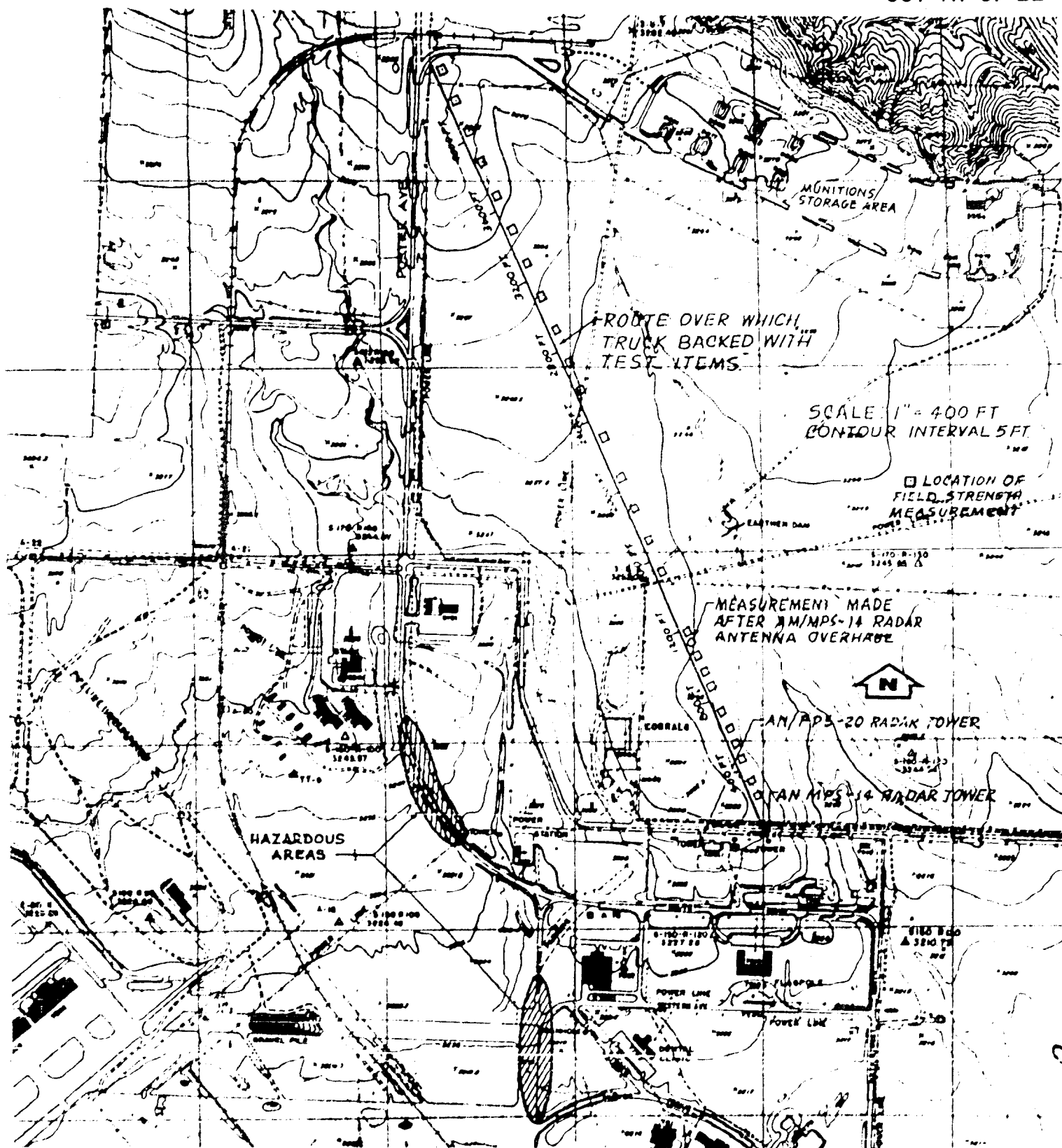


FIGURE 14.

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LOCATION OF FIELD MEASUREMENTS	DISTANCE FROM RADAR TOWER (FEET)	RADAR	FM READING	FREE SPACE CONVERSION FACTOR TO DB/M	CABLE LOSS	TOTAL DB/M	VOLTS/PEAK	WATTS/CM ² PEAK	WATTS/CM ² AVE X 10 ⁻³	THEORETICAL		
										PAR FIELD CORRECTION	NEAR FIELD CORRECTION	CORRECTED WATTS/CM ² X 10 ⁻³
Front of Bldg 9016	3575	AN/FPS-20	140	22.8	2.7	143.3	198.4	0.00941	0.0067	0.0934	1	0.178
Front of Bldg 9016	1575	AN/MPS-14	148	22.1	3.5	173.6	478.6	0.0608	0.0438	0.178	1	0.178
Front of Bldg 9015	3475	AN/FPS-20	141	22.8	2.7	166.5	211.3	0.0118	0.0085	0.0991	1	0.0991
Front of Bldg 9015	3475	AN/MPS-14	150	22.1	3.5	173.6	602.6	0.0963	0.0693	0.189	1	0.189
Front of Bldg 9011	3200	AN/FPS-20	133	22.8	2.7	158.5	84.1	0.00186	0.0014	0.1161	1	0.1161
Front of Bldg 9011	3200	AN/MPS-14	148	22.1	3.5	173.6	478.6	0.0608	0.0438	0.223	1	0.223
Front of Bldg 9008	3625	AN/FPS-20	140	22.8	2.7	165.5	165.4	0.00941	0.0068	0.0906	1	0.0906
Front of Bldg 9008	3625	AN/MPS-14	150	22.1	3.5	173.6	602.6	0.0963	0.0693	0.173	1	0.173
Front of Bldg 9003	3875	AN/FPS-20	136	22.8	2.7	161.5	104.4	0.00289	0.0021	0.0793	1	0.0793
Front of Bldg 9003	3875	AN/MPS-14	150	22.1	3.5	173.6	602.6	0.0963	0.0693	0.152	1	0.152
Rushmore Gate	4450	AN/FPS-20	140	22.8	2.7	165.5	188.4	0.00941	0.0068	0.0607	1	0.0607
Rushmore Gate	4450	AN/MPS-14	148	22.1	3.5	173.6	478.6	0.0608	0.0438	0.115	1	0.115
Intersection of Rushmore Gate Road to Rushmore	3350	AN/MPS-14	151	22.1	3.5	176.6	676.1	0.1212	0.0873	0.203	1	0.203
Intersection of South Drive & Ramp Street	1250	AN/FPS-20	135	22.8	2.7	154.5	53.1	0.000748	0.0005	0.762	1	0.762
Intersection of section of Porter Ave & Road to Munition Storage Area	1250	AN/MPS-14	138	22.1	3.5	153.6	131.4	0.00608	0.0044	1.46	1	1.46
	4071.5	AN/MPS-14	150	22.1	3.5	173.6	602.6	0.0963	0.0693	0.138	1	0.138
	3971.5	AN/MPS-14	153	22.1	3.5	178.6	851.0	0.192	0.138	0.145	1	0.145
	3871.5	AN/MPS-14	154	22.1	3.5	179.6	935.0	0.242	0.174	0.152	1	0.152
	3671.5	AN/MPS-14	154	22.1	3.5	179.6	935.0	0.242	0.174	0.169	1	0.169
	3471.5	AN/MPS-14	157	22.1	3.5	182.6	1149.0	0.443	0.318	0.189	1	0.189
	3271.5	AN/MPS-14	162	22.1	3.5	187.6	2099.0	1.527	1.099	0.213	1	0.213
	3071.5	AN/MPS-14	166	22.1	3.5	191.6	3802.0	3.834	2.76	0.241	1	0.241
	2871.5	AN/MPS-14	168	22.1	3.5	193.6	4786.0	6.076	4.37	0.276	1	0.276
	2671.5	AN/MPS-14	168	22.1	3.5	193.6	4786.0	6.076	4.37	0.319	1	0.319
	2471.5	AN/MPS-14	168	22.1	3.5	193.6	4786.0	6.076	4.37	0.373	1	0.373
	2271.5	AN/MPS-14	171	22.1	3.5	196.6	9500.0	24.192	17.4	0.442	1	0.442
	2071.5	AN/MPS-14	170	22.1	3.5	195.6	6036.0	9.632	6.93	0.531	1	0.531
	1871.5	AN/MPS-14	168	22.1	3.5	196.6	6761.0	12.125	8.73	0.651	0.98	0.651
	1671.5	AN/MPS-14	168	22.1	3.5	193.6	4786.0	6.076	4.37	0.815	0.96	0.815
	1471.5	AN/MPS-14	168	22.1	3.5	193.6	4786.0	6.076	4.37	1.05	0.94	0.987
	1271.5	AN/MPS-14	168	22.1	3.5	191.6	3802.0	3.834	2.76	1.66	0.92	1.527
	1071.5	AN/MPS-14	156	22.1	3.5	181.6	1202.0	0.3832	0.276	1.99	0.90	1.791
	871.5	AN/MPS-14	156	22.1	3.5	181.6	1202.0	0.3832	0.276	2.42	0.88	2.13
	671.5	AN/MPS-14	155	22.1	3.5	180.6	1072.0	0.3048	0.219	3.00	0.86	2.56
	471.5	AN/MPS-14	147	22.1	3.5	172.6	426.0	0.0481	0.0346	3.83	0.83	3.18
	271.5	AN/MPS-14	140	22.1	3.5	165.6	190.3	0.0096	0.00691	5.06	0.78	3.93
	71.5	AN/MPS-14	143	22.1	3.5	166.6	269.2	0.0192	0.0138	6.98	0.72	5.93
	471.5	AN/MPS-14	139	22.1	3.5	164.6	169.2	0.0076	0.00547	10.3	0.55	6.70
	271.5	AN/MPS-14	143	22.1	3.5	168.6	269.2	0.0192	0.0138	16.5	0.53	8.75
	71.5	AN/MPS-14	143	22.1	3.5	168.6	269.2	0.0192	0.0138	30.9	0.40	13.36
**	1130.0	AN/MPS-14			3.0db				3.24	1.76	0.925	1.63

TABLE 1. Electromagnetic Hazard Survey at Ellsworth Air Force Base, South Dakota - Data and Calculations.

*Last Point where field strength meter directly in axis of radar beam.

**Heading taken in same location after AN/MPS-14 Radar Antenna overhaul meter used reads average power.

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<p>AD</p> <p>2705th Air Operations Wing (COMAW), Hill Air Force Base, Utah ELECTROMAGNETIC RADIATION HAZARDS TO EXPLOSIVES SURVEY OF ELLSWORTH AIR FORCE BASE, SOUTH DAKOTA, by Harold R. Loughner, June 1961, 41p incl. figures and table. (OOA-78-61-22)</p> <p>Unclassified Report</p> <p>The purpose of this survey was to determine the extent of electromagnetic radiation hazards to explosives in storage, handling and shipping areas in the vicinity of the A.C. and W. site at Ellsworth Air Force Base, South Dakota. Field strength measurements of the main beams from the AM/PPS-20 and AM/PPS-14 radars were made at various locations in the aforementioned areas and along the transportation route. Various electrically initiated explosive items were exposed to the main beam of the radars, following the highest terrain possible into the AM/PPS-14 radar system. It was concluded that a degree of hazard does exist along the transportation route to the munitions storage area.</p>	<p>UNCLASSIFIED</p> <p>1. Electromagnetic Radiation</p> <p>I. Harold R. Loughner</p>	<p>AD</p> <p>2705th Air Operations Wing (COMAW), Hill Air Force Base, Utah ELECTROMAGNETIC RADIATION HAZARDS TO EXPLOSIVES SURVEY OF ELLSWORTH AIR FORCE BASE, SOUTH DAKOTA, by Harold R. Loughner, June 1961, 41p incl. figures and table. (OOA-78-61-22)</p> <p>Unclassified Report</p> <p>The purpose of this survey was to determine the extent of electromagnetic radiation hazards to explosives in storage, handling and shipping areas in the vicinity of the A.C. and W. site at Ellsworth Air Force Base, South Dakota. Field strength measurements of the main beams from the AM/PPS-20 and AM/PPS-14 radars were made at various locations in the aforementioned areas and along the transportation route. Various electrically initiated explosive items were exposed to the main beam of the radars, following the highest terrain possible into the AM/PPS-14 radar system. It was concluded that a degree of hazard does exist along the transportation route to the munitions storage area.</p>	<p>UNCLASSIFIED</p> <p>1. Electromagnetic Radiation</p> <p>I. Harold R. Loughner</p>
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